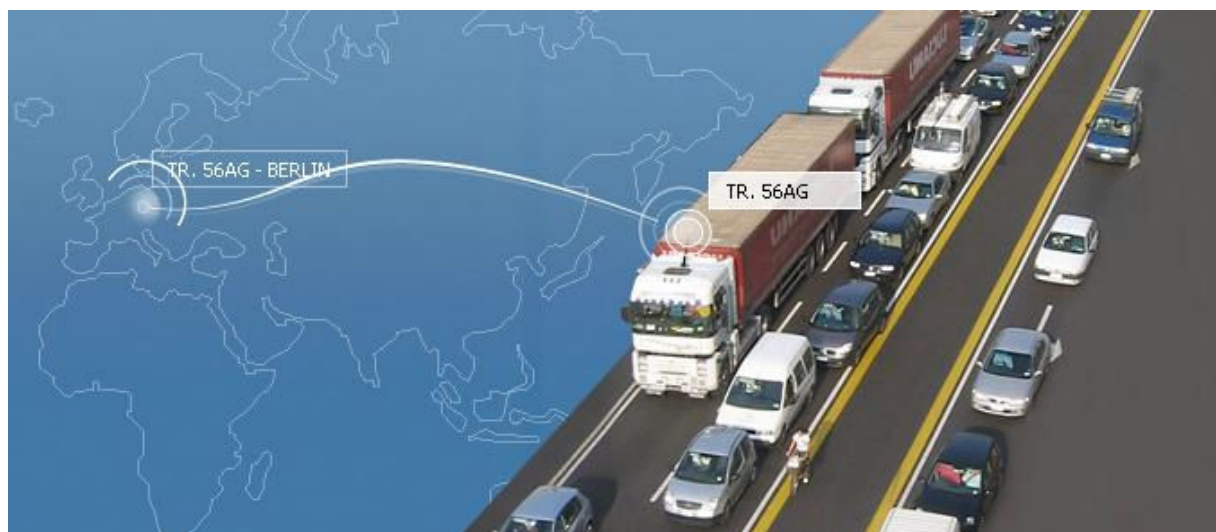


TAVL



User Manual
v2.1

This document describes TAVL telemetric moving object control system; it's structure, features, client application functions and using methods.

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1. Introduction

JSC Teltonika is proud to present a new telemetric solution, which integrates moving object control tools, effective remote object data transfer, powerful logistic tool and low maintenance expenses. Growing needs for such system and existence of cheap connection boosted system creation.

This AVL (Automatic Vehicle Location) software enables reduction of vehicles outage, delivery time, service costs and increase of transportation efficiency. These solutions allow effectively manage staff work, analyze results and structure conclusions.

System also enables object's on-line tracking and detection of dishonesty, thefts etc. System can automatically execute special tasks, such as monitoring object's temperature, informing about events etc.

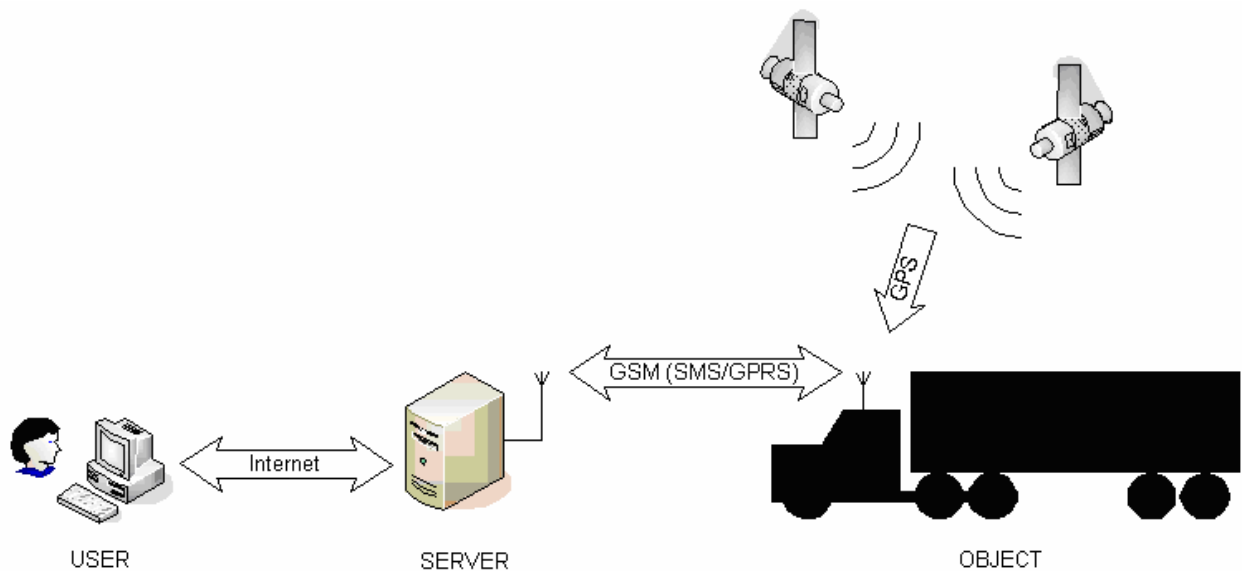
All mentioned features and possibilities prove, that system is a perfect tool for effective management of your transport company.

The system is good solution for companies whose success depends on transport service quality and efficiency.

2. System Overview

2.1 The Basics

The module, which is installed in the object, receives GPS satellites information and calculates its position in global coordinates system. Coordinates data is gathered in modules internal memory as well as other object information (temperature, battery voltage, etc.) and in fixed time intervals are sent (SMS or GPRS) to the server. The server processes that data and presents it to the user, who is connected to the server with his PC using TAVL application.



The system embraces technical solution (installed object with connected sensors), connectivity solution (data exchange between object and server in GSM network) and IT solution (data accumulation, processing and accessing with TAVL user application).

2.2 Main Functions

- ✓ System shows objects location on the integrated map (MS MapPoint Europe 2002 or any other vector map).
- ✓ Object coordinates and speed registration in fixed intervals (time may vary from 1 minute to 24 hours).
- ✓ Object's track calculation and display on the map.
- ✓ Object's parameters registration and display on the TAVL application (temperature, fuel in tanks, engine work time, door opening and closing, etc.)

- ✓ Graphical system reports information about object.
- ✓ System informs user about set parameters change (door opened, temperature dropped or raised beyond specified) in real time.
- ✓ GeoFence function lets you define a geographic zone, which borders crossing generate a message that is sent to the user by SMS or e-mail.
- ✓ Gathered data is sent to server by GPRS in fixed intervals (which may vary from 1 minute to 24 hours) or SMS (usually 1 to 3 times per day), considering which operators network module is in and thus saving data sending expenses. Despite the chosen method, user can always send a request about object's whereabouts and receive it by SMS.
- ✓ With the help of the system user can communicate with drivers or other employees by sending them the SMS.

3. Data Accumulation And Transfer

3.1 Data accumulation

There are two possibilities to acquire data: every configured time or every configured distance. Every sampling interval Imlet is checking if the distance from last position to current position is equal to or higher than the acquired distance. If it is so, Imlet saves the position and other data to memory. If it is not so, Imlet is checking if the time between last saved position and current time is equal to or higher than the sapling interval. If it is so, Imlet saves the position and other data to memory. If it is not, waits for new data and repeats the cycle. More data saved means more precise information displayed, but it also means that more information is sent to the server, which takes more time and increases transfer cost.

3.2 Events

Data received from sensors is identified as passive and active. Active data can be analyzed in real-time in module. When one of the parameters value is out of the defined range, module immediately sends message to server. Message includes information about event, its parameters and coordinates. Server sends message information (by SMS or e-mail) to everyone listed in the configuration list. In cases, when object is out of GSM coverage, module waits till object reaches GSM coverage zone and then immediately sends the message. Have in mind that when GSM connectivity is not possible and events accumulate, module can remember only last ten. Previous events are overwritten.

Passive data is accumulated along with coordinates and both are sent periodically. When GSM connectivity is not possible, data is written to the internal module memory. When memory limit is reached, oldest data is overwritten. With standard settings module can keep two to three weeks old records.

3.3 Data transfer by GPRS

GPRS is the most cost and speed-effective way to transfer accumulated data to server. When data is transferred to server, it is deleted from modules memory to make space for new data. When working in different operator networks, module chooses the most optimum transfer type depending

on the operators transfer costs. When module can't transfer data by GPRS for a long time (object is abroad or out of GSM coverage) data is accumulated till GPRS service is available. T-Box/GPS module uses UDP protocol, which reduces sent traffic and respectively lowers data transfer cost.

3.4 Data transfer by SMS


As an alternative to GPRS, T-Box/GPS module can send data by SMS. Every day, at defined time (time and number of transfers is configurable parameters) module sends SMS message with 24 coordinates, including time and speed. Other sensors data is not transferred. It is accumulated in the memory until GPRS connection can be established and confirmation about received data is received from server. In spite of chosen transfer type, user can always request the objects location and receive it by SMS.

4. TAVL user application

4.1 PC Requirements

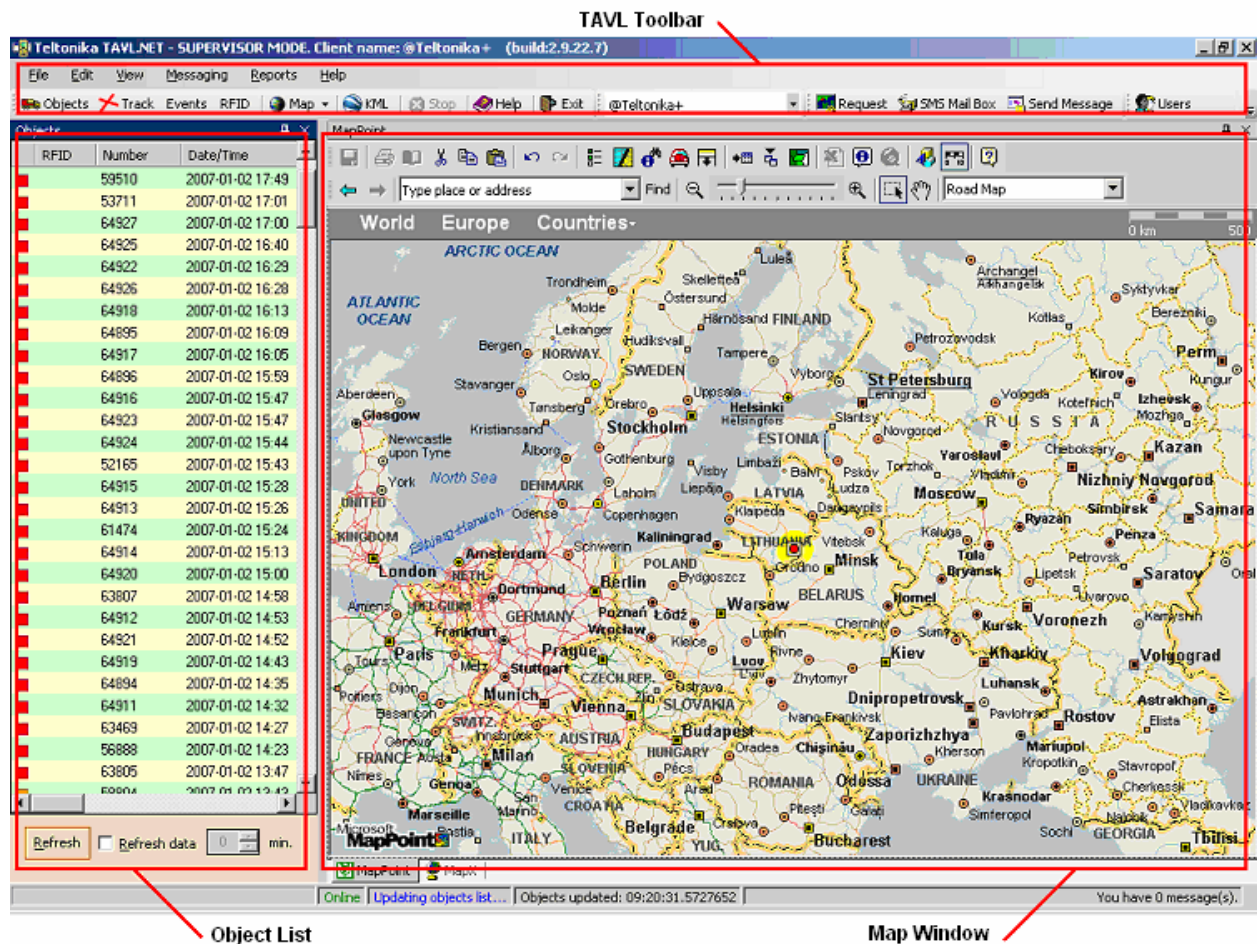
For the TAVL application to work properly, a computer with Internet is required with installed Microsoft Windows 2000 SP3 or Windows XP SP2 operating system, NET Framework 2.0 environment and cartographic program packet. (Akis, MS MapPoint Europe 2002, etc.).

4.2 Login

To start working, launch client's application. Enter your login name and password. To change server or language, click  button and enter Server name or its IP and choose the desired language.

4.3 User interface

TAVL user interface consists of three basic parts: TAVL toolbar, object list window, which can include track, event and other windows if selected and map window in which objects are displayed.

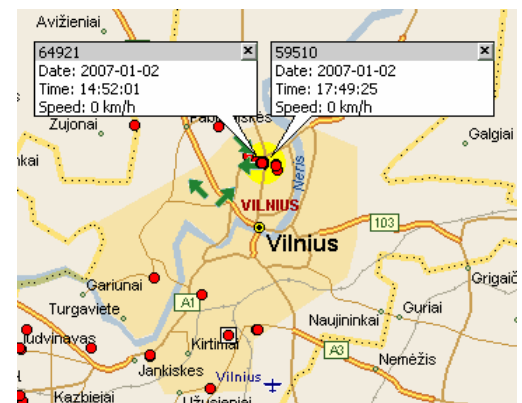


4.4 Objects

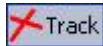
After clicking button in TAVL toolbar, all objects are indicated in the map. If the object doesn't move, it's shown as a red point. If object is moving at that moment, it is indicated as green arrow showing movement direction in the map.

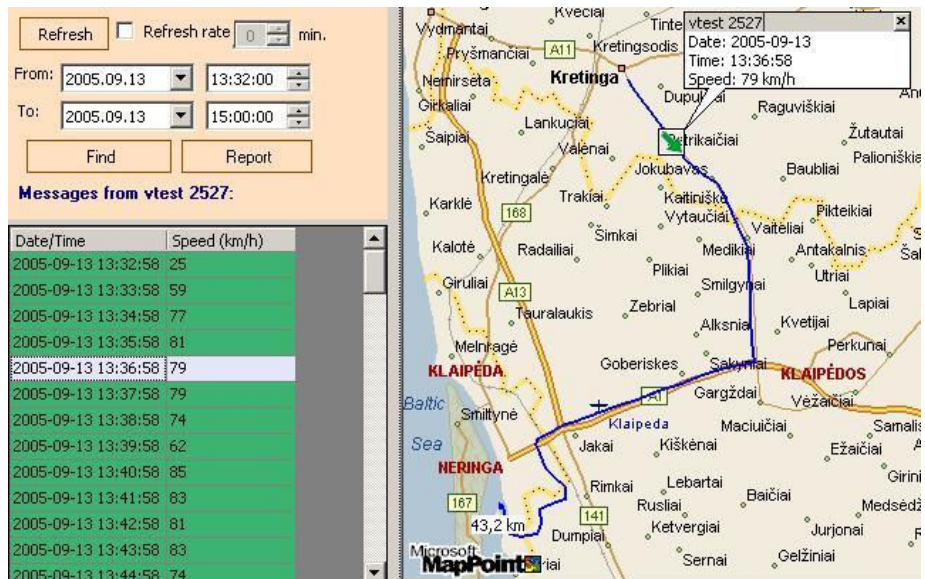
Double-click on the object shows object name, time and date when data was sent and speed that object was moving at that moment. Another way to find object in the map is to click on its name in the objects list. The map will be zoomed to show the location.

In status bar you can set time period in which information will be refreshed, or simply click "Refresh" button.



4.5 Track

After clicking  button in TAVL toolbar, tracking time fields in status window appear. Fill textbox with time period in which you are interested, select the object from the list and click “Find”. Application will transfer data from server and show them in the list



Refresh ☐ Refresh rate 0 min.

From: 2005.09.13 13:32:00 To: 2005.09.13 15:00:00

Find Report

Messages from vtest 2527:

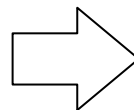
Date/Time	Speed (km/h)
2005-09-13 13:32:58	25
2005-09-13 13:33:58	59
2005-09-13 13:34:58	77
2005-09-13 13:35:58	81
2005-09-13 13:36:58	79
2005-09-13 13:37:58	79
2005-09-13 13:38:58	74
2005-09-13 13:39:58	62
2005-09-13 13:40:58	85
2005-09-13 13:41:58	83
2005-09-13 13:42:58	81
2005-09-13 13:43:58	83
2005-09-13 13:44:58	74

MapPoint

box bellow (time, speed and other measured parameters). There will also be object’s trail in the map, which corresponds to list box entries (if you click on the time entry in the list, the point, indicating object’s position and movement direction at defined time, will be shown in the map). Also, if you double-click on the track in the map, a record will be highlighted in the box list with data at that point.

To estimate distance between two points of the track mark the points holding button “Ctrl”. Message box will appear. You’ll be able to see information for chosen period of time in it.

Date/Time	Speed (km/h)	Geofence
2005-09-27 08:35:26	0	-
2005-09-27 08:35:46	0	-
2005-09-27 08:36:06	0	-
2005-09-27 08:36:26	18	-
2005-09-27 08:36:46	46	-
2005-09-27 08:37:06	25	-
2005-09-27 08:37:26	16	-
2005-09-27 08:37:46	33	-
2005-09-27 08:38:06	24	-
2005-09-27 08:38:26	42	-
2005-09-27 08:38:46	12	-




Track distance for Toyota Car

Distance: 1,015 km.

Period: 2005-09-27 08:36:26 - 2005-09-27 08:38:26

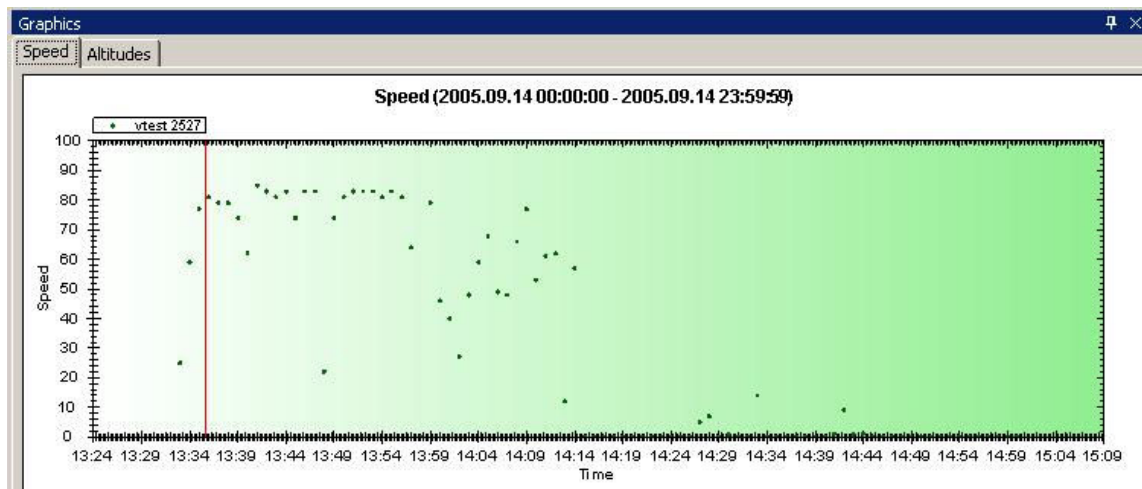
OK

4.6 Graphic Reports

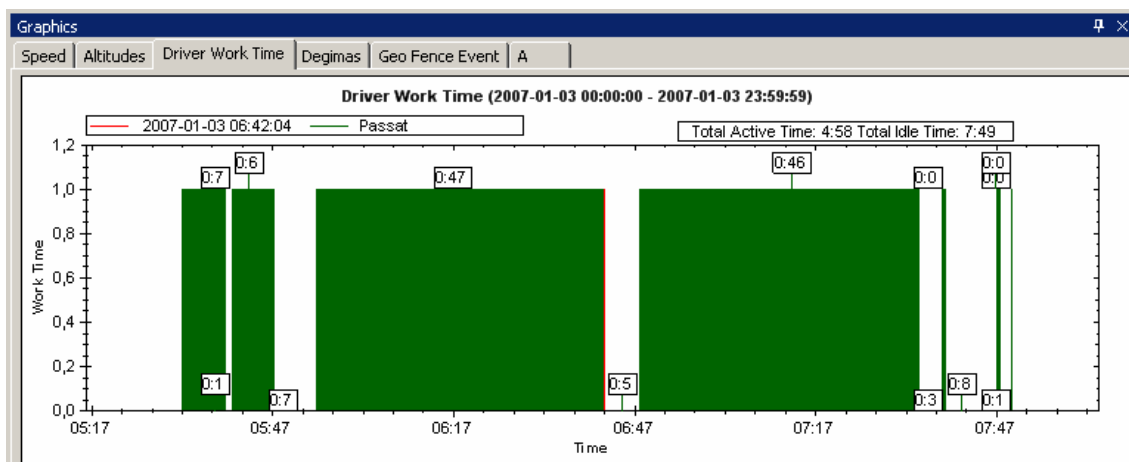
Sometimes text data listed in the table is quite inconvenient for analysis. You can make tracking reports that indicate parameters and their change in time. To do that, graphic reports functions have been created. They represent registered parameters and their changes in time scale.

After generating path in the map using “Find” button, you can click “Report” button. New

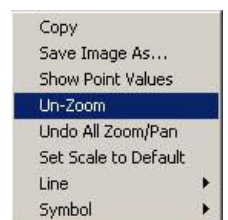
“Graphics” window appears. Diagrams of parameter’s changes are shown in the picture below.



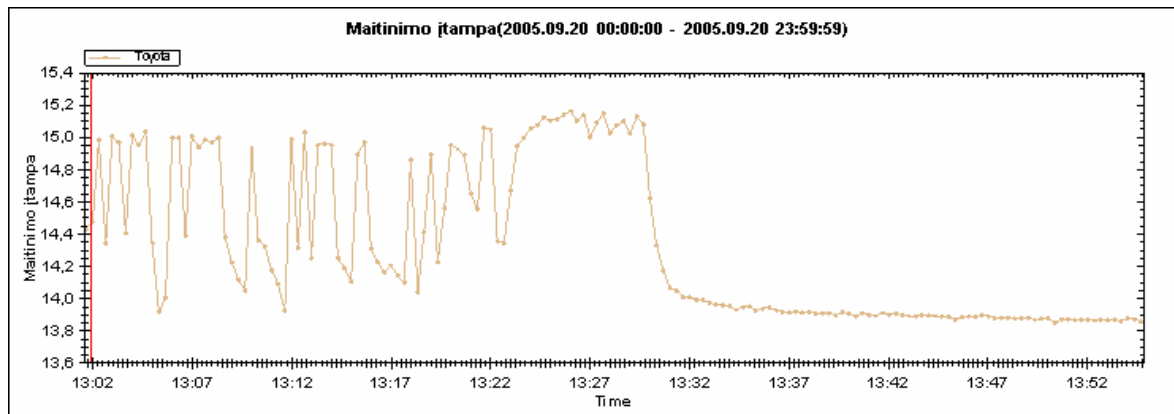
If no other parameters are registered, there will only be two diagrams: Speed and Altitude. In other cases you’ll be able to see all registered parameters. In the additional diagram Driver Work Time the objects movement in time is tracked (distance and time can be set) and if these parameters correspond those which are set, the objects working time is being registered. Keep in mind, that only objects movement is registered as working time, so program will not take into account any time spent in one place even with engine on.



To get better view, you can manage diagrams using mouse. You can use zoom by rolling mouse wheel or select rectangular while holding mouse left button. To call management menu, simply click mouse right button on the diagram. You will be able to “Copy” image to clipboard, or save image in picture format (“Save Image As...”). By clicking “Show point values”, point values will appear if you



move mouse pointer close to the point. "Un-zoom" function decreases view per step. "Undo all zoom/pan" function returns diagram to the primal view. To view diagram in standard scale (recommended) use "Set scale to default".

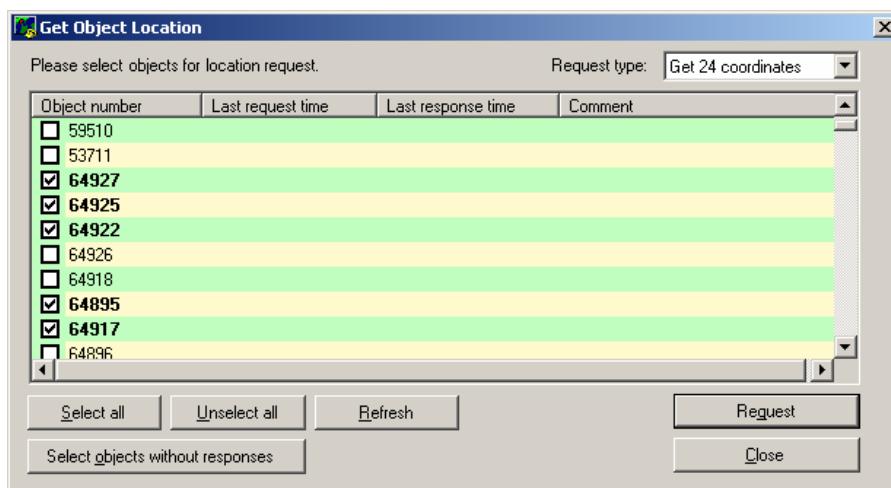


To connect diagram points using lines click "Line" and check ☒ "Show". To show points in other symbol type click "Symbol". After choosing one, select it's size.

When you select point from the list in track data box, red vertical line selects your parameter value in diagram.

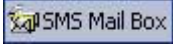
4.7 Request


If you click  button, „Get object location“ window appears. In the Request Type field choose what kind of request would you like to send: SMS with 24 coordinates, one last coordinate or all data by GPRS. When you want to send a request about object's current location, select (☒) an object from the list and click "Request location" button. If object can connect to its GSM provider, it will send the coordinates.




If you want to send request to the objects, which haven't responded since last request – click "Select object without responses" button.

4.8 Additional functions

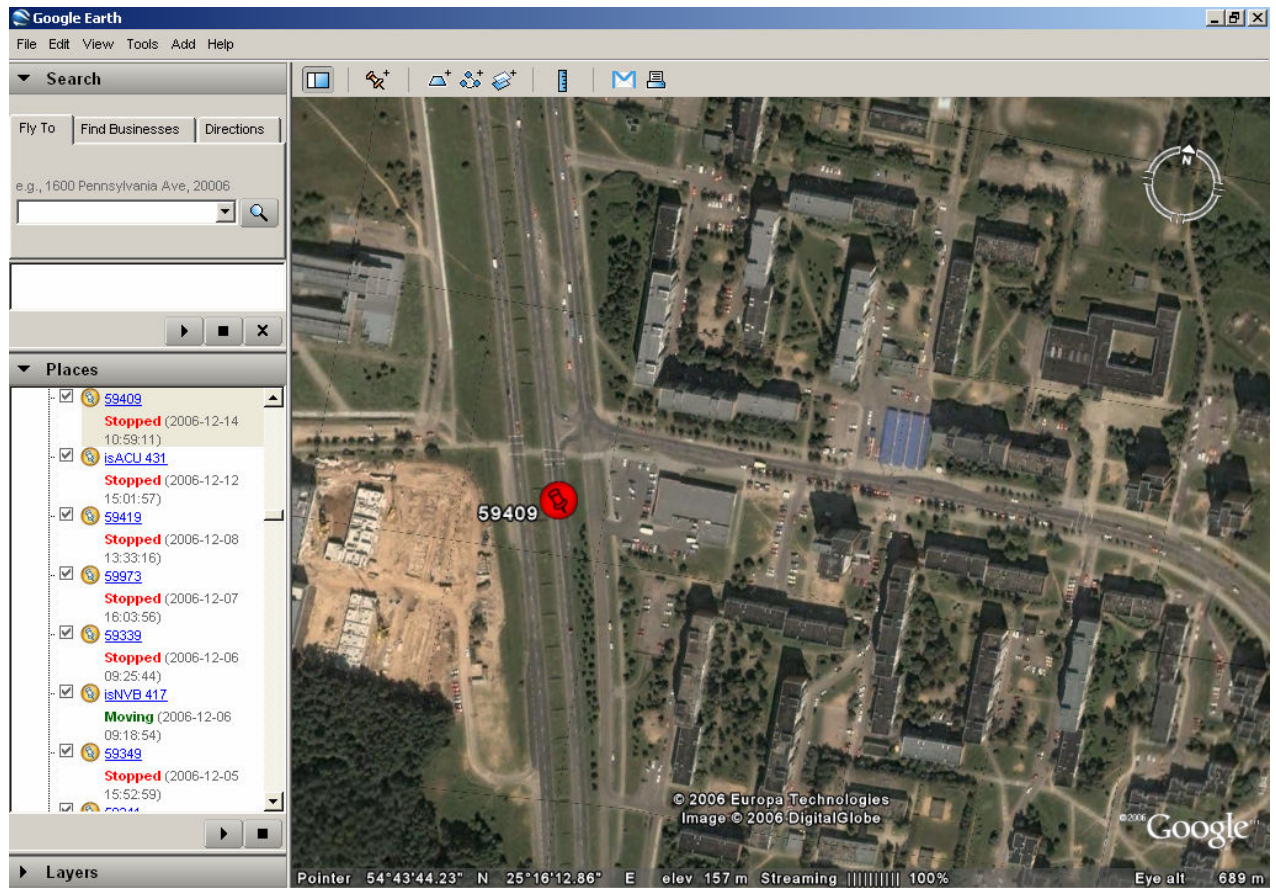
If you have certain services enabled, you can use SMS Mailbox function. By clicking  button you can open SMS register. SMS delivery reports („SMS delivered“), real time object's position request („Get SMS with 24 coordinates“), SMS messages that have been sent to employees and other commands that are important for administration are saved in this folder.

System also has integrated employee phone book. Clicking  button opens phone book window. Once you enter your employees phone numbers, you'll be able to send them SMS message directly from the TAVL system.

After clicking  button, window where you can send an SMS message appears. You can either choose employee from the list or simply enter any phone number.

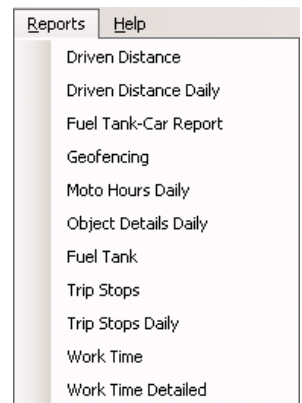
4.9 Other facilities (Export & Print)

After generating track, you can export track data table to CSV format, which is MS Excel friendly or KML format, which is supported by Google Earth. Just click "File", then "Export" in standard toolbar. Also you can print track map by clicking "File", then "Print MapPoint".



4.10 Statistic Reports

In the TAVL toolbar choose "Reports" and click on report type you want to view. In the new window choose the object and time period. "Driven Distance" and "Driven Distance Daily" produces total or daily driven road. "Geofencing" produces statistics when object entered or left specified areas. "Moto Hours Daily" produces engine working time and used fuel actual and average statistics, "Fuel Tank" - refueling and used fuel statistics, also calculates average usage for hundred kilometers. "Trip Stops" and "Trips Stops Daily" produces a statistic about object's idle time. "Worktime" and "Worktime Detailed" produces objects engine working time - total for each day or detailed with starting and ending time.



4.11 Options

"Options" allows you to customise TAVL applications settings. In the "View" menu choose "Options". To change settings either choose a value from the list or enter your own.

"Stop Speed" - speed value at which the object is treated as not moving. This is used when coordinates error occurs and object is replaced, it should not be indicated as changing its stopping point.

"Trace Events" - sets if passive data is displayed in new window when its state changes or with all data in the objects window. Interval sets the period in seconds when the data is to be refreshed.

"Geofence" setting let you specify line colours and width.

"Graphic Parameters" these settings define graphic reports parameters - fonts and their sizes, symbol types and sizes, etc. "Work Time Graphic Min Time" and "Work Time Graphic Min Speed" define minimum time and speed values at which object's engine is being treated as working.

"Use IButton" lets you use IButton function.

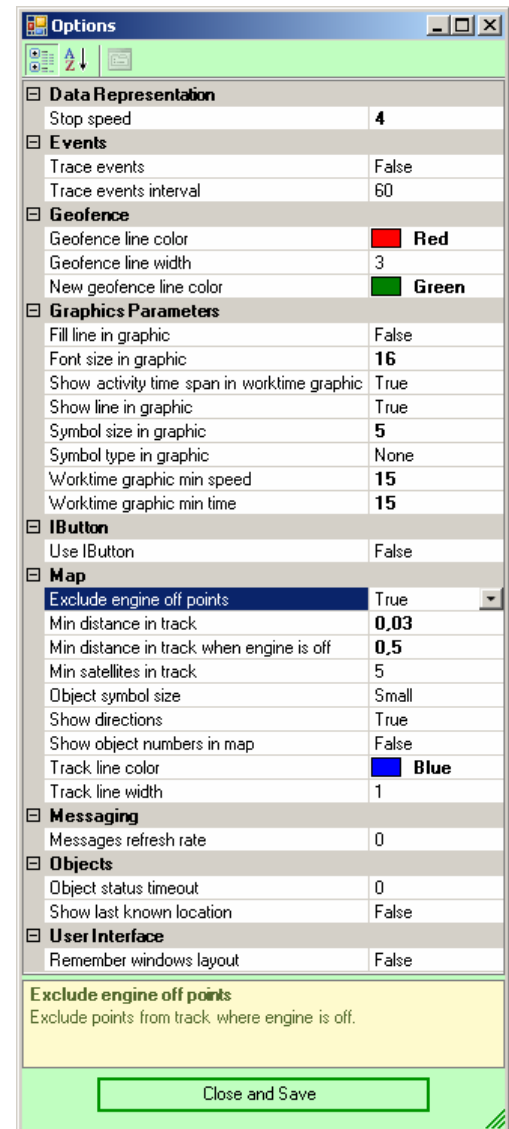
"Map" menu defines visual parameters in the TAVL map window. "Exclude Engine Off Points" sets object to not moving when engine is turned off. With this parameter "Min Distance In Track When Engine Is Off" is set in kilometres to indicate how far object can move so it will be treated as moving. "Min Distance In Track" sets minimum distance from one point to another in the map. "Min Satellites In Track" specifies how many satellites should module be using when defining its position. Note that minimum three satellites can be used, but more means better accuracy.

"Messages Refresh Rate" rate at which data is refreshed in mailbox.

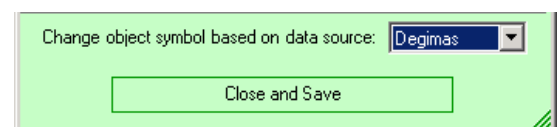
"Objects" shows last known good coordination when no GPS satellites are in view.

"Remember Windows Layout" saves windows layout in TAVL on exit.

It is also possible to set different symbols to represent the object while ignition is on or fuel counters are being used.



Options	
Data Representation	
Stop speed	4
Events	
Trace events	False
Trace events interval	60
Geofence	
Geofence line color	Red
Geofence line width	3
New geofence line color	Green
Graphics Parameters	
Fill line in graphic	False
Font size in graphic	16
Show activity time span in worktime graphic	True
Show line in graphic	True
Symbol size in graphic	5
Symbol type in graphic	None
Worktime graphic min speed	15
Worktime graphic min time	15
IButton	
Use IButton	False
Map	
Exclude engine off points	True
Min distance in track	0.03
Min distance in track when engine is off	0.5
Min satellites in track	5
Object symbol size	Small
Show directions	True
Show object numbers in map	False
Track line color	Blue
Track line width	1
Messaging	
Messages refresh rate	0
Objects	
Object status timeout	0
Show last known location	False
User Interface	
Remember windows layout	False
Exclude engine off points Exclude points from track where engine is off.	
Close and Save	



Change object symbol based on data source: Degimas

Close and Save

4.12 Web and Wap Applications

If you have certain features enabled, you can view objects in your Internet browser or with mobile phone, which supports Wap applications. Login using your username and password and choose one of the following - a list with numeric coordinates values and locality or one object in the integrated map. This is a simplified version of the TAVL application that lets you see newest and most important information anywhere you go.



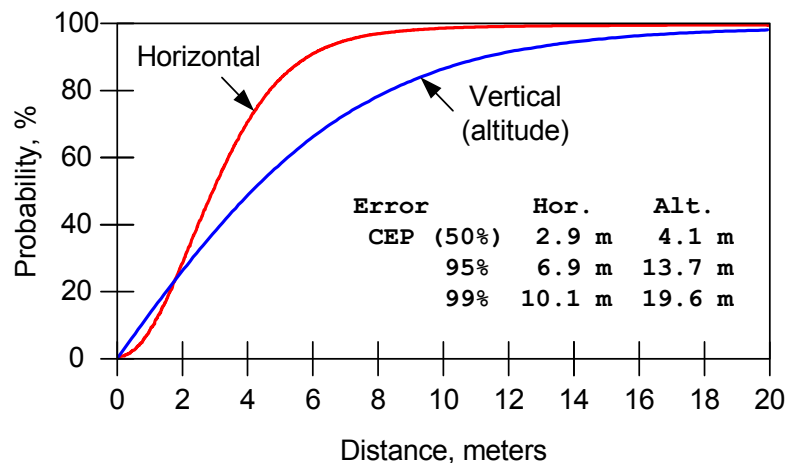
Teltonika T-AVL										
EN LT										
Main Objects Map Configuration Logout										
Select client: @Teltonika+ Change										
Main - Objects										
Client: @Teltonika+										
Status	Number	Time	Speed (km/h)	Country	City	Settlement	Latitude	Longitude	Comment	Date
■	48093	7/25/2006 11:30:23 AM	0	LITHUANIA	Vilnius (3.8 km)	Antakalnis (2.2 km)	54.715217590332	25.2957725524902		
■	48095	7/25/2006 11:20:02 AM	0	LITHUANIA	Vilnius (3.8 km)	Antakalnis (2.2 km)	54.7152519226074	25.2958030700684		
■	49716	8/21/2006 9:24:21 AM	0	LITHUANIA	Vilnius (3.8 km)	Kalvarijos (2.1 km)	54.7156639099121	25.2951698303223		
■	49718	8/19/2006 1:24:53 PM	0	LITHUANIA	Vilnius (3.8 km)	Kalvarijos (2.2 km)	54.7152290344238	25.2954559326172		
■	49719	9/21/2006 10:59:35 AM	0	LITHUANIA	Vilnius (3.8 km)	Antakalnis (2.2 km)	54.7152290344238	25.2957077026367		
■	49787	8/4/2006 4:11:06 PM	0	LITHUANIA	Vilnius (3.8 km)	Antakalnis (2.2 km)	54.7152976989746	25.2959156036377		
■	50013	8/22/2006 2:04:29 PM	0	LITHUANIA	Klaipeda (18 km)	Kvietiniai (0.2 km)	55.7481002807617	21.4004993438721		
■	50016	8/11/2006 3:01:27 PM	0	LITHUANIA	Vilnius (3.8 km)	Kalvarijos (2.2 km)	54.7152481079102	25.2954521179199		
■	50147	8/22/2006 2:27:42 PM	0	LITHUANIA	Klaipeda (18 km)	Kvietiniai (0.2 km)	55.747974395752	21.4006481170654		
■	50148	11/21/2006 3:44:25 PM	0	LITHUANIA	Vilnius (4.4 km)	Kirtimai (2.2 km)	54.652587890625	25.2737674713135		
■	50153	11/17/2006 1:11:00 PM	0	LITHUANIA	Vilnius (7.3 km)	Uzusieniai (1.4 km)	54.6452980041504	25.2243347167969		
■	50559	8/23/2006 3:47:35 PM	0	LITHUANIA	Vilnius (3.8 km)	Kalvarijos (2.2 km)	54.7152633666992	25.2954044342041		
■	50572	8/23/2006 2:47:44 PM	0	LITHUANIA	Vilnius (3.8 km)	Kalvarijos (2.2 km)	54.7152633666992	25.2954158782959		
■	52503	10/13/2006 9:36:14 AM	0	LITHUANIA	Vilnius (3.8 km)	Kalvarijos (2.2 km)	54.7152671813965	25.2954750061035		
■	52547	9/8/2006 8:57:58 AM	0	LITHUANIA	Vilnius (3.8 km)	Kalvarijos (2.1 km)	54.7153549194336	25.2956123352051		
■	52973	9/12/2006 1:38:00 PM	0	LITHUANIA	Vilnius (3.6 km)	Kirtimai (2.4 km)	54.6543884277344	25.2917709350586		
■	52978	9/12/2006 2:24:30 PM	0	LITHUANIA	Vilnius (3.8 km)	Kalvarijos (2.2 km)	54.7152709960938	25.295539855957		

1 2 3 4 5 ... >>

5. Frequently asked questions (FAQ)

1. Why does objects trail don't match roads that are shown in the map? What is the accuracy of GPS?

Object trail doesn't coincide with roads shown in the maps because of GPS limited accuracy. GPS accuracy depends on location (geographic latitude, longitude), satellites' location and ionosphere's conditions. In perfect conditions (sunny weather, no clouds, in open area, without skyscrapers, woods) accuracy can be about 3 – 5 meters.



Usually accuracy is estimated using statistical method CEP (Circle of Equal Probability). This method allows us to consider, that in probability of 50%, object's coordinates' error does not exceed designated values.

Otherwise, roads in the map not always are defined very precisely (especially considering Eastern Europe). Another possibility is that new roads don't exist in the map.

2. Why do data transfers from server to application take so long?

Duration of data transfers from server to user application depends on amount of data and speed of Internet connectivity. While object registers many parameters very often grows data quantity. Then transfer time for long requested period of time could be very long. So if you want to increase data transfer time you should decrease requested data time period.

One more way to decrease data transfer time is to decrease frequency of object's parameters data (time T_1 should be not 1 minute but 2 – 3 minutes).

3. Why it is impossible to request current object position?

In most cases you are unable to receive information about current object's location, because it

is out of GSM coverage (is in the sea, in deep woods, etc.)

4. It's one or two hours since module sent its data. Why is it not refreshed?

Module is sending data to the server at fixed time. If the connection is not possible (there is no GPRS context), the next sending will be at fixed time. Still You can send the request, and get the latest data.

5. Why only yesterdays data is shown?

Either module didn't sent data because it's not time to do it or he couldn't send it because of network problems. Solution is to configure module so it will send data at desired time.

6. How can I know objects location if it is not sending data by GPRS?

You can send a request and get the SMS with 24 coordinates.

7. Why is object changing its coordinates even when engine is off?

It is because of GPS accuracy. If object is standing between tall buildings or in from of the wall, module doesn't see enough satellites to set it's exact coordinates. Then each coordinate is calculated with a slight error.

6. Changes Log Sheet

Nr.	Date	New version number	Comments
1	070416	2.1	TAVL title changes, Reports updated, Options updated, Web and Wap interface example added